SEISMIC ANISOTROPY IN THE SOUTHEASTERN AND NORTHEASTERN EDGE OF THE TIBETAN PLATEAU

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Since the period of the Indosinian movement, especially due to the Himalayan tectonic evolution, with the Tibetan Plateau (i.e. Qinghai-Xizang Plateau) intensely lifts, there are collisions and extrusions of continental crusts in different degrees and different styles. Due to strong collision between the Indian plate and the Eurasian plate, there are many large active faults and lots of strong earthquakes within and around Tibetan Plateau. In southeastern edge of Tibetan Plateau, GPS results indicate the crust movement to clearly SE and show rotation clockwise (Gan et al. 2007). However, in northeastern edge of Tibetan Plateau, the crust movement is clearly to NE and NEE, as well as rotation clockwise. How is the deep deformation and deep substance migration? We have known both lithospheric deformation and asthenospheric flow can lead to observed mantle anisotropy. In reverse, seismic anisotropy can be adopted to detect the stress, deformation and movement process in the crust and in the mantle.

When shear-wave propagates through anisotropic rocks in the crust, it can split into two

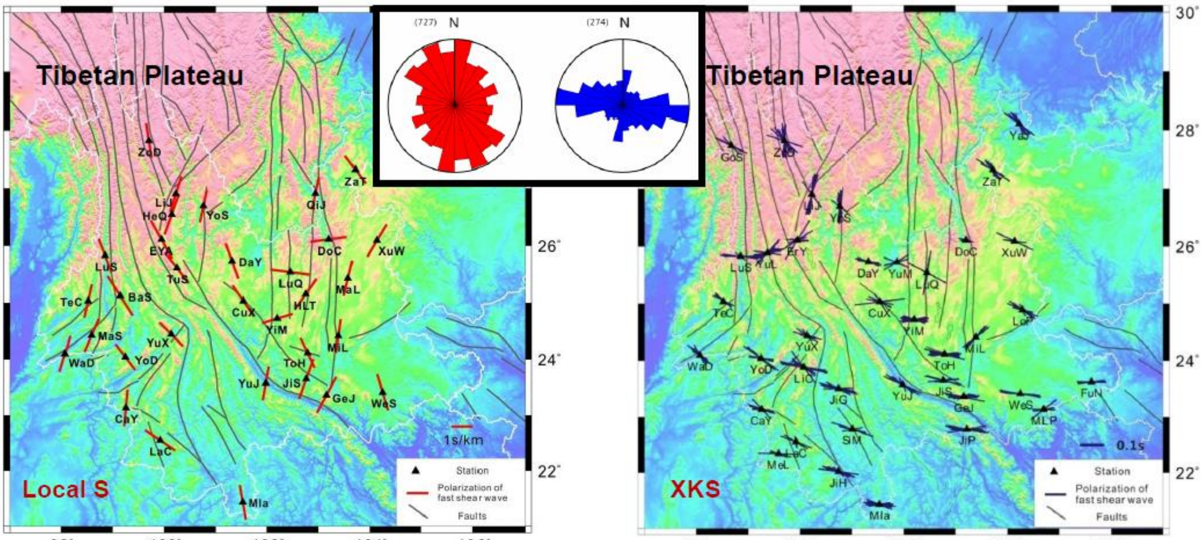

Figure 1. Polarizations of fast shear-waves and fast XKS (SKS, PKS and SKKS) phases in Southeastern edge of the Tibetan Plateau
The left is diagram from local earthquakes which means anisotropy in the crust. The red lines are average fast polarization at stations. The right is diagram of XKS (i.e. SKS, PKS and SKKS) splitting which means anisotropy in the upper mantle. The blue lines show fast XKS polarizations at stations. The middle-upper shows the homolographic projection rose diagrams for all records of local shear-waves in red and XKS phases in blue.

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independent components with almost orthogonal polarizations. For nearly vertical propagation, the polarization of fast shear wave is parallel to both the strike of the cracks as well as the direction of maximum horizontal compressive stress. Therefore the polarization of fast shear wave can be adopted to study stress in the crust (Gao et al. 2011; 2012). Stress can influence crack density and aspect ratio of cracks in the crust (Crampin, 1994), the time-delay of slow shear-wave to fast shear-wave suggests the anisotropic degree and stress status. In this research, we measure shear-wave splitting of local seismic wave to study seismic anisotropy in the crust and splitting of SKS, PKS and SKKS (named XKS later) phases to study seismic anisotropy in the upper mantle.

In southeastern edge of Tibetan Plateau, we use local seismic data from January 2000 to October 2010 recorded by 32 stations to measure shear-wave splitting in the crust, use teleseismic data from August 2007 to October 2010 to measure XKS splitting in the upper mantle (Shi et al. 2012; Gao et al. 2012). Different seismic anisotropy suggests different deformation pattern in the crust and in the upper mantle (Figure 1).

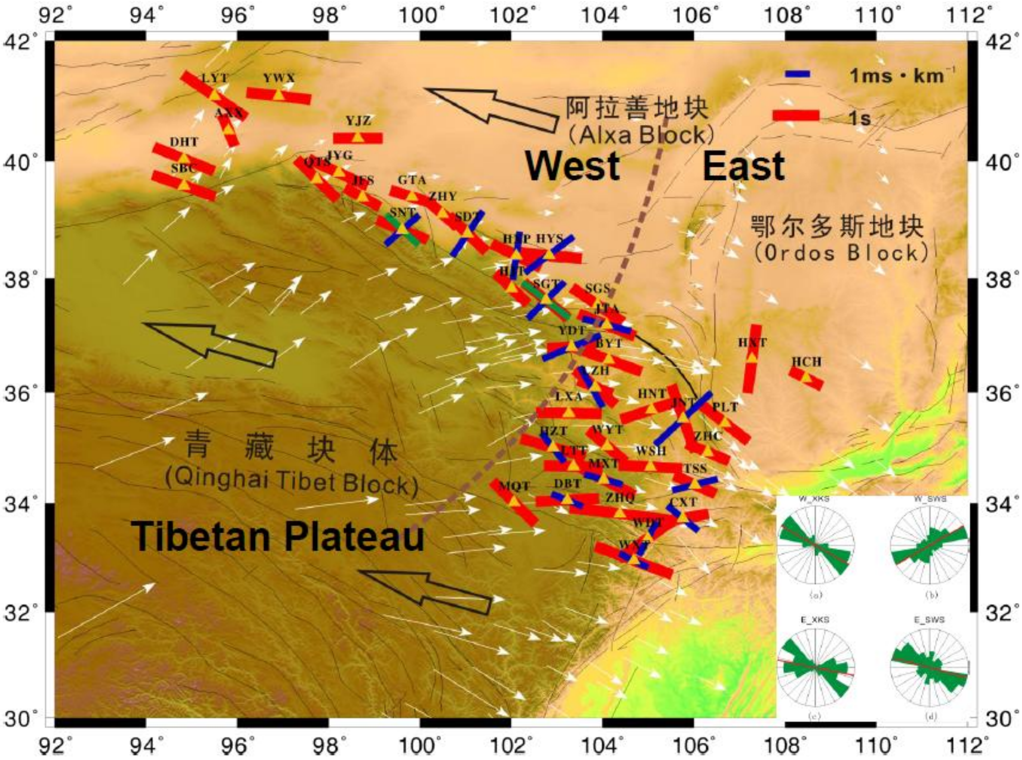

Figure 2. Polarizations of fast shear-waves and fast XKS (SKS, PKS and SKKS) phases in Northeastern edge of the Tibetan Plateau

White arrows are GPS movement direction. Black arrows are APM data. The red wide lines are average polarizations of fast XKS at stations. The blue lines are average polarizations of fast shear-waves from local small earthquakes at stations. Brown dashed line divides the study area by the East part and the West part. The right-bottom are the homolographic projection rose diagrams, where W_XKS is fast XKS polarization in the west part, W_SWS is fast shear-wave polarization in the crust in the west part, E_XKS is fast XKS polarization in the East part, E_SWS is fast shear-wave polarization in the crust in the East part.

In northeastern edge of Tibetan Plateau, local seismic data from January 2001 to December 2008 recorded by 18 stations are obtained to measure shear-wave splitting in the crust, teleseismic data from July 2007 to July 2010 are obtained to measure XKS splitting in the upper mantle (Wang et al. 2013; Zhang et al. 2012). According to measure results, the southeastern edge of Tibetan Plateau can be divided into two parts by the east part and the west part (Figure 2). In west part, predominant polarization direction of fast shear-wave in the crust is different to that of fast XKS in the upper mantle. They cross in a large angle near to orthogonal each other. In east part, however, predominant polarization direction of fast shear-wave in the crust is consistent with that of fast XKS in the upper mantle. GPS data seems also to show some different movement direction (Figure 2).

According to Gao et al. (2013) and Shi et al. (2013), the eastern edge of Tibetan Plateau also is distinct in seismic anisotropy although we need more investigation. More details about seismic anisotropy and deformation in the southeastern edge and northeastern edge of Tibetan Plateau will be discussed later in the 2004 General Assembly of European Seismological Commision.

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